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AMENDMENT UNDER 37 C.F.R. § 1.111
U.S. Application No. 09/686,959

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions and listings of claims in the application:

LISTING OF CLAIMS:

1. (Previously Presented) An ink-jet recording apparatus, which has a recording head provided close to an ink reservoir, said recording head ejecting ink from the ink reservoir, and driving signal generating means that generates a driving signal for ejecting ink droplets, comprising:

ink reservation amount obtaining means for obtaining the ink reservation amount in said ink reservoir;

temperature change amount obtaining means for obtaining the temperature change amount per unit of time of said recording head by a temperature sensor mounted on the recording head; and

ink consumption amount controlling means for controlling the ink consumption amount of said recording head based on the temperature change amount per unit of time of the recording head obtained by said temperature change amount obtaining means and the ink reservation amount obtained by said ink reservation amount obtaining means.

2 - 3. (Cancelled).

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4. (Original) The ink-jet recording apparatus according to claim 1, wherein said ink reservation amount obtaining means detects the ink consumption amount and obtains the ink reservation amount in said ink reservoir.

5. (Cancelled).

6. (Original) The ink-jet recording apparatus according to claim 1, wherein said temperature change amount obtaining means comprises temperature detecting means for detecting the temperature of the recording head and temperature information storing means for storing the head temperature information from the temperature detecting means.

7. (Original) The ink-jet recording apparatus according to claim 6, wherein said temperature information storing means stores the recording head temperature information from the time when a power source is turned on.

8. (Original) The ink-jet recording apparatus according to claim 6, wherein said temperature information storing means stores the head temperature information in the waiting state of the recording operation.

9. (Original) The ink-jet recording apparatus according to claim 6, wherein said temperature information storing means holds the stored head temperature information even after the power source is turned off.

10. (Original) The ink-jet recording apparatus according to claim 9, wherein said temperature change amount obtaining means obtains the temperature change amount by using the head temperature information held in the temperature information storing means when the power source is turned on again within a specified time after power source is turned off.

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11. (Original) The ink-jet recording apparatus according to claim 1, wherein said driving signal generating means generates a driving signal that makes the recording head perform a recording operation, and said ink consumption amount controlling means adjusts the driving signal for the recording operation.

12. (Original) The ink-jet recording apparatus according to claim 11, wherein said driving signal generating means generates a driving signal including the driving pulse for ejecting ink droplets, and said ink consumption amount controlling means adjusts the driving voltage of the driving pulse based on the temperature change amount and the ink reservation amount.

13. (Original) The ink-jet recording apparatus according to claim 11, wherein said driving signal generating means generates the driving signal including the driving pulse for ejecting ink droplets, and said ink consumption amount controlling means adjusts the pulse form of the driving pulse based on the temperature change amount and the ink reservation amount.

14 - 24. (Cancelled).

25. (Previously Presented) An ink-jet recording method, the method including use of a recording head provided close to an ink reservoir, said recording head ejecting ink from the ink reservoir, and driving signal generating means for generating a driving signal to eject droplets, the method comprising the steps of:

obtaining the ink reservation amount in said ink reservoir and obtaining the temperature change amount per unit of time of said recording head by a temperature sensor mounted on the recording head; and

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controlling the ink consumption amount of said recording head based on the temperature change amount per unit of time of said recording head and said ink reservation amount.

26 - 29. (Cancelled).

30. (Original) The ink-jet recording method according to claim 25, wherein said step of obtaining a temperature change amount of a recording head comprises the steps of:

detecting the temperature of said recording head; and

storing the detected head temperature information.

31. (Previously Presented) The ink-jet recording method according to claim 30, wherein during said step of storing head temperature information, the head temperature information is stored from the time the power source is turned on.

32. (Previously Presented) The ink-jet recording method according to claim 30, wherein during said step of storing the head temperature information, the head temperature information in the waiting state of the recording operation is stored.

33. (Previously Presented) The ink-jet recording method according to claim 30, wherein during said step of storing head temperature information, the stored head temperature information is held even after the power source is turned off.

34. (Previously Presented) The ink-jet recording method according to claim 33, wherein during said step of obtaining the temperature change amount of the recording head, the temperature change amount is obtained by using the stored detected head temperature, when the power source is turned on again within a specified time after the power source is turned off.

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35. (Previously Presented) The ink-jet recording method according to claim 25, wherein during said step of controlling the ink consumption amount, the driving signal that makes a said recording head perform to recording operation is adjusted.

36. (Previously Presented) The ink-jet recording method according to claim 35, wherein said adjustment of the driving signal of the recording operation is an adjustment of the driving voltage for the pulse form, which is included in the driving signal for ejecting ink droplets.

37. (Previously Presented) The ink-jet recording method according to claim 35, wherein said adjustment of the driving signal of the recording operation is an adjustment of the pulse form of the driving pulse, which is included in the driving signal for ejecting ink droplets.

38 - 48. (Cancelled).

49. (Previously Presented) A computer program product for controlling the ink consumption amount of an ink-jet recording apparatus, comprising:

a recording medium capable of being read by a computer, and

a program of computer readable instructions adapted to enable the control of an ink-jet recording apparatus to perform the steps of:

executing printing by using a recording head provided close to an ink reservoir, said recording head ejecting ink from the ink reservoir;

obtaining an ink reservation amount in said ink reservoir;

obtaining a temperature change amount of said recording head; and

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controlling the ink consumption amount of the recording head based on said-temperature change amount per unit of time of said recording head-by a temperature sensor mounted on the recording head and said ink reservation amount.

50. (Previously Presented) An ink-jet recording apparatus, comprising:

a recording head, an ink reservoir, a drive signal generating section, an ink reservation amount obtaining section, a temperature change amount obtaining section, and an ink consumption amount controlling section;

said recording head provided close to said ink reservoir, said recording head receiving ink from the ink reservoir;

said drive signal generating section generating a driving signal;

said recording head ejecting ink droplets of said ink, based on said driving signal, at an ink consumption amount;

said ink reservation amount obtaining section obtaining an ink reservation amount in said ink reservoir;

said temperature change amount obtaining section obtaining a temperature change amount per unit of time of said recording head by a temperature sensor mounted on the recording head; and

said ink consumption amount controlling section controlling said ink consumption amount of said recording head based on said-temperature change amount per unit of time and ink reservation amount.

51 - 52. (Cancelled).

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53. (Previously Presented) The ink-jet recording apparatus according to claim 50, wherein said ink reservation amount obtaining section detects the ink consumption amount and obtains the ink reservation amount in said ink reservoir.

54. (Cancelled).

55. (Previously Presented) The ink-jet recording apparatus according to claim 50, wherein said temperature change amount obtaining section comprises a temperature detecting section for detecting the temperature of the recording head and a temperature information storing section for storing the head temperature information from the temperature detecting section.

56. (Previously Presented) The ink-jet recording apparatus according to claim 55, wherein said temperature information storing section stores the recording head temperature information from the time when a power source is turned on.

57. (Previously Presented) The ink-jet recording apparatus according to claim 55, wherein said temperature information storing section stores the head temperature information in the waiting state of the recording operation.

58. (Previously Presented) The ink-jet recording apparatus according to claim 55, wherein said temperature information storing section holds the stored head temperature information even after the power source is turned off.

59. (Previously Presented) The ink-jet recording apparatus according to claim 58, wherein said temperature change amount obtaining section obtains the temperature change amount by using the head temperature information held in the temperature information storing

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section when the power source is turned on again within a specified time after power source is turned off.

60. (Previously Presented) The ink-jet recording apparatus according to claim 50, wherein said driving signal generating section generates a driving signal that makes the recording head perform a recording operation, and said ink consumption amount controlling section adjusts the driving signal for the recording operation.

61. (Previously Presented) The ink-jet recording apparatus according to claim 60, wherein said driving signal generating section generates a driving signal including the driving pulse for ejecting ink droplets, and said ink consumption amount controlling section adjusts the driving voltage of the driving pulse based on the temperature change amount and the ink reservation amount.

62. (Previously Presented) The ink-jet recording apparatus according to claim 60, wherein said driving signal generating section generates the driving signal including the driving pulse for ejecting ink droplets, and said ink consumption amount controlling section adjusts the pulse form of the driving pulse based on the temperature change amount and the ink reservation amount.

63 - 73. (Cancelled).

74. (Previously Presented) An ink-jet recording method, in which the ink-jet recording apparatus has a recording head provided close to an ink reservoir, said recording head ejecting ink from the ink reservoir, and a driving signal generating section for generating a driving signal to eject droplets, the method comprising the steps of:

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obtaining the ink reservation amount in said ink reservoir and
obtaining the temperature change amount per unit of time of said recording head by a
temperature sensor mounted on the recording head; and
controlling the ink consumption amount of said recording head based on the temperature
change amount per unit of time of said recording head and said ink reservation amount.

75 - 76. (Cancelled).

77. (Previously Presented) The ink-jet recording method according to claim 74,
wherein said ink reservation amount is obtained by calculation based on totalization of the ink
consumption amount.

78. (Cancelled).

79. (Previously Presented) The ink-jet recording method according to claim 74,
wherein said step of obtaining a temperature change amount of a recording head comprises the
steps of:

detecting the temperature of said recording head; and
storing the detected head temperature information.

80. (Previously Presented) The ink-jet recording method according to claim 79,
wherein during said step of storing head temperature information, the head temperature
information is stored from the time when the power source is turned on.

81. (Previously Presented) The ink-jet recording method according to claim 79,
wherein during said step of storing the head temperature information, the head temperature
information in the waiting state of the recording operation is stored.

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82. (Previously Presented) The ink-jet recording method according to claim 79, wherein during said step of storing head temperature information, the stored head temperature information is held even after the power source is turned off.

83. (Previously Presented) The ink-jet recording method according to claim 82, wherein during said step of obtaining the temperature change amount of the recording head, the temperature change amount is obtained by using the stored detected head temperature information, when the power source is turned on again within a specified time after the power source is turned off.

84. (Previously Presented) The ink-jet recording method according to claim 74, wherein during said step of controlling the ink consumption amount, the driving signal that makes the recording head perform the recording operation is adjusted.

85. (Previously Presented) The ink-jet recording method according to claim 84, wherein said adjustment of the driving signal of the recording operation is an adjustment of the driving voltage for the pulse form, which is included in the driving signal for ejecting ink droplets.

86. (Previously Presented) The ink-jet recording method according to claim 84, wherein said adjustment of the driving signal of the recording operation is an adjustment of the pulse form of the driving pulse, which is included in the driving signal for ejecting ink droplets.

87 - 97. (Cancelled).

98. (Previously Presented) The ink-jet recording apparatus according to claim 1, wherein the ink consumption amount controlling means controls the ink consumption amount

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on the basis of the ink reservation amount and the temperature change amount per unit of time of the recording head, while taking actual ink temperature into consideration.

99. (Previously Presented) The ink-jet recording apparatus according to claim 98, wherein the ink consumption amount controlling means controls the ink consumption amount by inferring an actual ink temperature on the basis of the ink reservation amount and the temperature change amount per unit of time of the recording head, and in accordance with the thus inferred ink temperature.

100. (Previously Presented) The ink-jet recording apparatus according to claim 98, wherein the ink consumption amount controlling means in order to directly control a parameter to be used in controlling the ink consumption amount, without inferring actual ink temperature, on the basis of the ink reservation amount and the temperature change amount per unit of time of the recording head.

101. (Previously Presented) The ink-jet recording method according to claim 25, wherein said step of controlling the ink consumption amount further includes the ink consumption amount being controlled on the basis of the ink reservation amount and the temperature change amount per unit of time of the recording head, while taking actual ink temperature into consideration.

102. (Previously Presented) The ink-jet recording method according to claim 101, wherein said step of controlling the ink consumption amount further includes the ink consumption being controlled by inferring an actual ink temperature on the basis of the ink

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reservation amount and the temperature change amount per unit of time of the recording head, and in accordance with the thus inferred ink temperature.

103. (Previously Presented) The ink-jet recording method according to claim 101, wherein said step of controlling the ink consumption amount further includes directly controlling a parameter to be used in controlling the ink consumption amount, without inferring actual ink temperature, on the basis of the ink reservation amount and the temperature change amount per unit of time of the recording head.

104. (Previously Presented) The computer program product for controlling the ink consumption amount of an ink jet recording apparatus according to claim 49, wherein controlling the ink consumption amount of the recording head includes controlling the ink consumption amount on the basis of the ink reservation amount and the temperature change amount per unit of time of the recording head, while taking actual ink temperature into consideration.

105. (Previously Presented) The computer program product for controlling the ink consumption amount of an ink jet recording apparatus according to claim 104, wherein said controlling the ink consumption amount includes controlling the ink consumption amount by inferring an actual ink temperature on the basis of the ink reservation amount and the temperature change amount per unit of time of the recording head, and in accordance with the thus inferred ink temperature.

106. (Previously Presented) The computer program product for controlling the ink consumption amount of an ink jet recording apparatus according to claim 104, wherein said

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controlling the ink consumption amount includes directly controlling a parameter to be used in controlling the ink consumption amount, without inferring actual ink temperature, on the basis of the ink reservation amount and the temperature change amount per unit of time of the recording head.

107. (Previously Presented) The ink-jet recording apparatus according to claim 50, wherein said ink consumption amount controlling section controls the ink consumption amount on the basis of the ink reservation amount and the temperature change amount per unit of time of the recording head, while taking actual ink temperature into consideration.

108. (Previously Presented) The ink-jet recording apparatus according to claim 107, wherein said ink consumption amount controlling section controls the ink consumption amount by inferring an actual ink temperature on the basis of the ink reservation amount and the temperature change amount per unit of time of the recording head, and in accordance with the thus inferred ink temperature.

109. (Previously Presented) The ink-jet recording apparatus according to claim 107, wherein said ink consumption amount controlling section directly controls a parameter to be used in controlling the ink consumption amount, without inferring actual ink temperature, on the basis of the ink reservation amount and the temperature change amount per unit of time of the recording head.

110. (Previously Presented) The ink-jet recording method according to claim 74, wherein said step of controlling the ink consumption amount further includes the ink consumption amount being controlled on the basis of the ink reservation amount and the

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temperature change amount per unit of time of the recording head, while taking actual ink temperature into consideration.

111. (Previously Presented) The ink-jet recording method according to claim 110, wherein said step of controlling the ink consumption amount further includes the ink consumption amount being controlled by inferring an actual ink temperature on the basis of the ink reservation amount and the temperature change amount per unit of time of the recording head, and in accordance with the thus inferred ink temperature.

112. (Previously Presented) The ink-jet recording method according to claim 110, wherein said step of controlling the ink consumption amount further includes directly controlling a parameter to be used in controlling the ink consumption amount, without inferring actual ink temperature, on the basis of the ink reservation amount and the temperature change amount per unit of time of the recording head.

113. (Previously Presented) An ink-jet recording apparatus, which has a recording head provided close to an ink reservoir, said recording head ejecting ink from the ink reservoir, and driving signal generating means that generates a driving signal for ejecting ink droplets, comprising:

ink reservation amount obtaining means for obtaining the ink reservation amount in said ink reservoir;

temperature change amount obtaining means for obtaining the temperature change amount per unit of time of said recording head by a temperature sensor mounted on the recording head; and

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ink consumption amount controlling means for controlling the ink consumption amount of said recording head based at least on the ink reservation amount as a function of the temperature change amount per unit of time.

114. (Previously Presented) The ink-jet recording apparatus of claim 113, wherein the ink reservation amount as a function of the temperature change amount per unit of time is based on the formula:

$$T = T_t + k \Delta T,$$

wherein T = the ink temperature, T_t = the detected head temperature, k is an adjustment coefficient, and ΔT is a temperature change amount.

115. (Previously Presented) An ink-jet recording method, the method including use of a recording head provided close to an ink reservoir, said recording head ejecting ink from the ink reservoir, and driving signal generating means for generating a driving signal to eject droplets, the method comprising the steps of:

obtaining the ink reservation amount in said ink reservoir and obtaining the temperature change amount per unit of time of said recording head by a temperature sensor mounted on the recording head; and

controlling the ink consumption amount of said recording head based at least on the ink reservation amount as a function of a temperature change amount per unit of time.

116. (Previously Presented) The ink-jet recording method of claim 115, wherein the ink reservation amount as a function of the temperature change amount per unit of time is based on the formula:

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$$T = T_t + k \Delta T,$$

wherein T = the ink temperature, T_t = the detected head temperature, k is an adjustment coefficient, and ΔT is a temperature change amount.

117. (Previously Presented) A computer program product for controlling the ink consumption amount of an ink-jet recording apparatus, comprising:

a recording medium capable of being read by a computer, and

a program of computer readable instructions adapted to enable the control of an ink-jet recording apparatus to perform the steps of:

executing printing by using a recording head provided close to an ink reservoir, said recording head ejecting ink from the ink reservoir;

obtaining an ink reservation amount in said ink reservoir;

obtaining a temperature change amount of said recording head; and

controlling the ink consumption amount of the recording head based at least on the ink reservation amount as a function of the temperature change amount per unit of time.

118. (Previously Presented) The computer program product of claim 117, wherein the ink reservation amount as a function of the temperature change amount per unit of time is based on the formula:

$$T = T_t + k \Delta T,$$

wherein T = the ink temperature, T_t = the detected head temperature, k is an adjustment coefficient, and ΔT is a temperature change amount.

119. (Previously Presented) An ink-jet recording apparatus, comprising:

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a recording head, an ink reservoir, a drive signal generating section, an ink reservation amount obtaining section, a temperature change amount obtaining section, and an ink consumption amount controlling section;

said recording head provided close to said ink reservoir, said recording head receiving ink from the ink reservoir;

said drive signal generating section generating a driving signal;

said recording head ejecting ink droplets of said ink, based on said driving signal, at an ink consumption amount;

said ink reservation amount obtaining section obtaining an ink reservation amount in said ink reservoir;

said temperature change amount obtaining section obtaining a temperature change amount per unit of time of said recording head by a temperature sensor mounted on the recording head; and

said ink consumption amount controlling section controlling said ink consumption amount of said recording head based on at least the ink reservation amount as a function of the temperature change amount per unit of time.

120. (Previously Presented) The ink-jet recording apparatus of claim 119, wherein the ink reservation amount as a function of the temperature change amount per unit of time is based on the formula:

$$T = T_t + k \Delta T,$$

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wherein T = the ink temperature, T_t = the detected head temperature, k is an adjustment coefficient, and ΔT is a temperature change amount.

121. (Previously Presented) An ink-jet recording method, in which the ink-jet recording apparatus has a recording head provided close to an ink reservoir, said recording head ejecting ink from the ink reservoir, and a driving signal generating section for generating a driving signal to eject droplets, the method comprising the steps of:

obtaining the ink reservation amount in said ink reservoir and

obtaining the temperature change amount per unit of time of said recording head by a temperature sensor mounted on the recording head; and

controlling the ink consumption amount of said recording head based on at least the ink reservation amount as a function of the temperature change amount per unit of time.

122. (Previously Presented) The ink-jet recording method of claim 121, wherein the ink reservation amount as a function of the temperature change amount per unit of time is based on the formula:

$$T = T_t + k \Delta T,$$

wherein T = the ink temperature, T_t = the detected head temperature, k is an adjustment coefficient, and ΔT is a temperature change amount.

123. (New) A printer system for printing ink to a page, including:

an ink reservoir;

a detector that detects a level of ink in the ink reservoir and produces an ink-level output signal based on said level of ink;

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a recording head;

a temperature sensor that detects the temperature of the recording head and produces a recording head-temperature signal;

a controller that receives said ink-level output signal and said recording head-temperature signal, said controller controlling the consumption of ink consumed by said recording head based on an amount of change per unit of time in the temperature of said recording head and said level of ink contained in said ink reservoir.

124. (New) The printer system of claim 123, including at least one memory device that stores said recording head-temperature signal from the time when a power source is turned on.

125. (New) The printer system of claim 124, wherein said at least one memory device stores the recording head-temperature signal in a waiting state of a recording operation.

126. (New) The printer system of claim 125, wherein said at least one memory device holds said stored recording head-temperature signal even after a power source is turned off.

127. (New) The printer system of claim 126, wherein said controller obtains a temperature change amount by using said at least one memory device when said power source is turned on again within a specified time after said power source is turned off.

128. (New) The printer system of claim 123, wherein said controller generates a driving signal that makes said recording head perform a recording operation.

129. (New) The printer system of claim 128, wherein said driving signal includes a driving pulse for ejecting ink droplets from said recording head, and said controller adjusts a

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driving voltage of the driving pulse based on information denoting a temperature change amount and an ink level amount received via said ink-level output signal and said recording head-temperature signal.